

WHAT IS CLAIMED IS:

1 1. A method of processing an observed pulse wave data, comprising
2 steps of:

3 irradiating a living body with a first light beam having a first
4 wavelength and a second light beam having a second wavelength which is
5 different from the first wavelength;

6 converting the first light beam and the second light beam, which have
7 been reflected or transmitted from the living body, into a first electric signal
8 corresponding to the first wavelength and a second electric signal
9 corresponding to the second wavelength, as the observed pulse data;

10 computing a light absorbance ratio obtained from the first electric
11 signal and the second electric signal, for each one of frequency ranges dividing
12 an observed frequency band; and

13 determining that noise is not mixed into the observed pulse wave data
14 in a case where a substantial match exists among light absorbance ratios
15 computed for the respective frequency ranges.

1 2. The signal processing method as set forth in claim 1, wherein the
2 existence of the substantial match of the light absorbance ratios is determined
3 with regard to frequency ranges in which at least one of the first electric signal
4 and the second electric signal has relatively large powers.

1 3. A method of processing an observed pulse wave data, comprising
2 steps of:

3 irradiating a living body with a first light beam having a first
4 wavelength and a second light beam having a second wavelength which is
5 different from the first wavelength;

6 converting the first light beam and the second light beam, which have
7 been reflected or transmitted from the living body, into a first electric signal
8 corresponding to the first wavelength and a second electric signal
9 corresponding to the second wavelength, as the observed pulse data; and

10 whitening the first electric signal and the second electric signal by an
11 affine transformation using a known light absorbance ratio, in order to separate
12 a pulse signal component and a noise component which are contained in the
13 observed pulse data.

1 4. The signal processing method as set forth in claim 3, wherein the
2 affine transformation is performed with the following equation:

$$\begin{pmatrix} S \\ N \end{pmatrix} = \begin{pmatrix} 1 & -\frac{1}{\tan \theta} \\ 0 & \frac{1}{\sin \theta} \end{pmatrix} \begin{pmatrix} \cos \phi & \sin \phi \\ -\sin \phi & \cos \phi \end{pmatrix} \begin{pmatrix} s_1 \\ s_2 \end{pmatrix}$$

4 where, S is the pulse signal component, N is the noise component, s₁ is the
5 first electric signal, s₂ is the second electric signal, $\phi = \tan^{-1} \Phi$, Φ is the known
6 light absorbance ratio, and θ is a value selected from a range of $-\phi$ to $(\pi/2 - \phi)$,
7 and

8 wherein θ is so selected as to make a norm of the pulse signal
9 component minimum.

1 5. The signal processing method as set forth in claim 3, further
2 comprising steps of:

3 computing a light absorbance ratio obtained from the first electric
4 signal and the second electric signal, for each one of frequency ranges dividing
5 an observed frequency band; and

6 determining that noise is not mixed into the observed pulse wave data
7 in a case where a substantial match exists among light absorbance ratios
8 computed for the respective frequency ranges,

9 wherein one of the light absorbance ratios, which are determined that
10 the noise is not mixed therein, is used as the known light absorbance ratio.

1 6. The signal processing method as set forth in claim 3, further
2 comprising a step of obtaining a signal-to-noise ratio of the observed pulse
3 wave data by performing a frequency analysis with respect to the pulse signal
4 component and the noise component at each of predetermined frequencies.

1 7. The signal processing method as set forth in claim 3, further
2 comprising a step of displaying a pulse wave of the living body, based on the
3 pulse signal component.

1 8. The signal processing method as set forth in claim 3, further
2 comprising a step of calculating a pulse rate of the living body based on the
3 pulse signal component.

1 9. A method of processing an observed pulse wave data, comprising
2 steps of:
3 irradiating a living body with a first light beam having a first

4 wavelength and a second light beam having a second wavelength which is
5 different from the first wavelength;

6 converting the first light beam and the second light beam, which have
7 been reflected or transmitted from the living body, into a first electric signal
8 corresponding to the first wavelength and a second electric signal
9 corresponding to the second wavelength, as the observed pulse data;

10 whitening the first electric signal and the second electric signal to
11 separate a pulse signal component and a noise component which are
12 contained in the observed pulse data, for each one of frequency ranges
13 dividing an observed frequency band.

1 10. The signal processing method as set forth in claim 9, wherein the step
2 of whitening the first electric signal and the second electric signal is performed
3 with independent component analysis.

1 11. The signal processing method as set forth in claim 9, further
2 comprising a step of obtaining a signal-to-noise ratio of the observed pulse
3 wave data by performing a frequency analysis with respect to the signal
4 component and the noise component at each one of the frequency ranges.

1 12. A pulse photometer, in which the signal processing method as set
2 forth in claim 1 is executed.

1 13. A pulse photometer, in which the signal processing method as set
2 forth in claim 3 is executed.

1 14. A pulse photometer, in which the signal processing method as set
2 forth in claim 9 is executed.